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(54) System for electronic data communication between two fluid reservoirs.

(57) A system for electronic data communication between two fluid reservoirs (15) interconnected by a conducting hose (11) for transferring fluid between said reservoirs. The system comprises a first electronic communication device (21) and a second electronic communication device (41) which is in communication with said first device via the hose. At least one electronic safety barrier (23,43) is provided, which safety barrier interconnects one of said communication devices and the hose.

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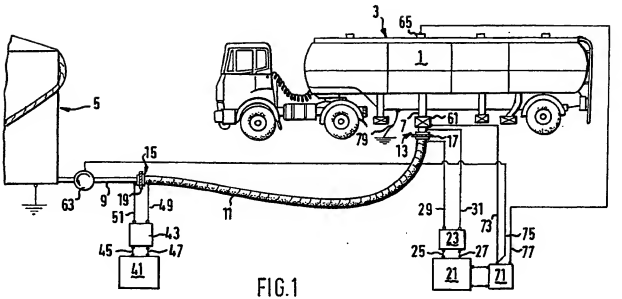
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FIG.1

SYSTEM FOR ELECTRONIC DATA COMMUNICATION BETWEEN TWO FLUID RESERVOIRS

The invention relates to a system for electronic data communication between two fluid reservoirs interconnected by a conducting hose for transferring fluid between said reservoirs.

Such an electronic data communication system is, for example, applied as a data link between a vehicle such as a road tanker and a fixed point like a loading or unloading point in the distribution of e.g. oil products or chemicals.

This data communication is based on the use of a conductive hose and an earth bonding cable and can be used to prevent operational (human) errors in the distribution of oil products and chemicals, for example, by identification of inlets, outlets and hoses.

Further, transmission of operational data over the same data link and generation of quality control records during and/or after the operational events can also be realised.

Electronic data communication between two reservoirs can for example be necessary to check whether the correct reservoirs are interconnected via the hose in order to ensure that the correct type of fluid will be transferred. It has frequently occurred that different types of fuel are unintendedly mixed due to wrong connections of the hose to reservoirs. Such incidents are referred to as cross-over of fluid.

In particular, prevention of misoperation in the distribution chain during loading and unloading of products at depots and retail stations is becoming increasingly important. To illustrate this imagine the consequences of unloading a leaded product into an unleaded retail storage tank. The majority of misoperations is caused by human errors. Presently only small parts of the operation and equipment can be fully automated and checked. As full automation without human intervention/operation seems unrealistic for the near future, the next logical step is to detect a (human) error and prevent it from resulting into misoperation.

European patent No. 258 935 discloses a method and system for checking loading/unloading of road tankers by means of an electromagnetic identification system. Electronic communication devices are coupled to a hose by means of inductive couplers. However, this known system is restricted to the use of inductive couplers and to the electronic identification of tanks or tank compartments only. Further, when the known system is used in an environment of inflammable vapours a dangerous situation can occur. Namely, if the electric energy in the system reaches a level at which sparks occur, for example due to an electric fault or electrostatic discharges, the sparks may ignite the vapours.

It is an object of the invention to provide a system for electronic data communication between two reservoirs, which system is intrinsically safe and can be safely used in an environment of inflammable vapours by keeping the level of electric energy automatically below the energy required to ignite inflammable vapours.

It is another object of the invention to provide a system for electronic data communication between two reservoirs wherein all relevant identification information, for example product code, tank or gantry number, customer or depot number, driver number, codes related to the loading/unloading point and the like, which extra information could be used to generate quality assurance records.

The invention therefore provides a system for electronic data communication between two fluid reservoirs interconnected by a conducting hose for transferring fluid between said reservoirs, characterized by:

- a first electronic communication device;
- a second electronic communication device which is in communication with said first device via the hose; and
- at least one electronic safety barrier, which safety barrier interconnects one of said communication devices and the hose.

The safety barrier limits the electric energy generated by said one communication device to a level at which sparks do not occur. Furthermore, the safety barrier allows communication of the communication devices with each other via the hose, while electrostatic charges in the hose are not dissipated said one communication devices but directly to the reservoirs to which the hose is connected.

Advantageously a first safety barrier interconnects the first communication device and the hose, and a second safety barrier interconnects the second communication device and the hose. In this manner the electric energy which may be generated by the first communication device and by the second communication device is limited to a level at which sparks do not occur.

The invention will now be explained by way of example in more detail with reference to the accompanying drawings in which:

Fig. 1 shows schematically a first advantageous embodiment of the system according to the invention;

Fig. 2 shows schematically a second advantageous embodiment of the system according to the invention; and

Fig. 3 shows schematically a detail of Figs. 1

and 2.

Referring to Fig. 1 there is shown a first reservoir in the form of a compartment 1 of a road tanker 3, and a second reservoir in the form of a fuel depot tank 5. The compartment 1 of the tanker 3 is provided with an inlet/outlet 7, and the depot tank 5 is provided with an outlet 9.

An electrically conducting hose 11 for transferring fuel from the depot tank 5 to the compartment 1 of the tanker 3 is at opposite ends connected to the outlet 9 of the depot tank 5 and to the inlet/outlet 7 of the compartment 1 by means of couplings 13,15. Each coupling 13,15 is provided with an insulator 17,19 for preventing electric currents to flow directly from the hose 11 to the depot tank 5 or the tanker 3.

A first communication device in the form of an electronic interrogator 21 and a first electronic safety barrier 23 are arranged in any way suitable for the purpose at the tanker 3. The first safety barrier 23 is connected to the interrogator 21 via any suitable connections 25,27, to the hose 11 via any suitable connection 29 and to the inlet/outlet 7 of the compartment 1 via any suitable connection 31.

A second communication device in the form of an electronic label 41 and a second electronic safety barrier 43 are arranged in any way suitable for the purpose near the depot tank 5. The second safety barrier 43 is suitably connected to the said label 41 via any suitable connections 45,47, to the hose 11 via any suitable connection 49 and to the outlet 9 of the depot tank 5 via any suitable connection 51.

The electronic label 41 may contain any relevant information, e.g. required product code, codes related to the depot tank 5, tank number and the like.

A valve 61 is provided at the inlet/outlet 7 of the compartment 1, and a pump 63 is provided at the outlet 9 of the depot tank 5, which valve 61 and pump 63 are both electronically controllable by the interrogator 21. An overfill detector 65 is arranged at the compartment 1, which detector 65 cooperates with the interrogator 21 so as to stop the pump 63 and to close the valve 61 when overfilling of the compartment 1 is detected. A third electronic safety barrier 71 connects the interrogator 21 with the valve 61, the pump 63 and the overfill detector 65 via connections 73,75,77.

The depot tank 5 is permanently connected to earth, while the tanker 3 is releasably connected to earth by means of an earth cable 79.

Fig.2 shows substantially the same embodiment as described with reference to Fig. 1, but with a second reservoir in the form of a fuel retail tank 85 and without connections of the third safety barrier 71 to a pump and an overfill detector. The retail tank has an inlet 87 to which the hose 11 is connected in any way suitable for the purpose. The second safety barrier is via connection 51 connected in any way suitable for the purpose to the inlet 87 of the retail tank.

Fig. 3 shows an example of an advantageous safety barrier 90 which can be applied in the embodiments of the system described thereinbefore. The safety barrier 90 includes four connections 91,92,93,94, two Zener diodes 95,96, two resistors 97,98 and a fuse 99. Other suitable examples of safety barriers which could be used in the system of the invention are indicated in the Measurement Technology Catalogue 1989.

The Zener diodes 95,96 of the safety barrier 90 limit the charges transmitted through the barrier 90 to the maximum charge at which the Zener diodes 95,96 become conducting, while the fuse 99 limits the currents transmitted through the barrier 90 to the maximum current of the fuse 99. Thus the electric energy which is transmitted by the safety barrier 90 is limited to a level at which ignition of explosive vapours does not occur.

The said first embodiment of the system according to the invention can for example be used as a cross-over prevention system in order to check whether the correct compartment 1 of the tanker 3 is connected via the hose 11 to the depot tank 5, so as to ensure that the correct type of fuel will be transferred from the depot tank 5 to the compartment 1. This is accomplished in the following manner. Information on the type of fuel present in the depot tank 5 is stored in the label 41. The interrogator 21 is then induced to transmit an interrogation signal via the first safety barrier 23, the hose 11 and the second safety barrier 43 to the label 41. The label 41 transmits a response signal in reverse direction to the interrogator 21, which response signal depends on the interrogation signal and on the information stored in the label 41. The response signal represents either that the correct compartment 1 is connected to the depot tank 5 or an incorrect compartment.

When the correct compartment 1 is connected to the depot tank 5, the interrogator 21 induces the valve 61 to open and the pump 63 to operate, so that fuel is transferred from the depot tank 5 to the compartment 1. When during transfer of fuel the overfill detector 65 detects overfilling of the compartment 1, the overfill detector 65 induces the interrogator 21 to stop operation of the pump 63 and to close the valve 61.

When an incorrect compartment is connected to the depot tank 5, the interrogator 21 does not induce the valve 61 to open and the pump 63 to operate so that transfer of fuel is prevented.

Use of the second embodiment of the system according to the invention can be made for example to check whether the correct compartment 1 of

the tanker 3 is connected via the hose 11 to the retail tank, so as to ensure that the correct type of fuel will be transferred from the compartment 1 to the retail tank 85. This is accomplished in the following manner. Information on the type of fuel which is to be stored in the retail tank 85 is stored in the label 41. The interrogator 21 is then induced to transmit an interrogation signal via the first safety barrier 23, the hose 11 and the second safety barrier 43 to the label 41. The label 41 transmits a response signal in reverse direction to the interrogator 21, which response signal depends on the interrogation signal and on the information stored in the label 41. The response signal represents that either the correct compartment 1 is connected to the retail tank 85 or an incorrect compartment.

In case that the correct compartment 1 is connected to the retail tank 85, the interrogator 21 induces the valve 61 to open so that fuel is allowed to flow from the compartment 1 through the hose 11 to the retail tank 85.

In case that an incorrect compartment is connected to the retail tank 85, the interrogator 21 does not induce the valve 61 to open so that transfer of fuel is prevented.

However, it will be appreciated by those skilled in the art that the present invention is not restricted to cross-over prevention systems, but, on the contrary, can also be applied as an intrinsically safe data link with integrated safety barriers for electronic transmission of relevant operational data, electronic identification of products and the like in the field of fuel and chemicals distribution.

Various modifications of the present invention will become apparent to those skilled in the art from the foregoing description and accompanying drawings. Such modifications are intended to fall within the scope of the appended claims.

Claims

1. A system for electronic data communication between two fluid reservoirs interconnected by a conducting hose for transferring fluid between said reservoirs, characterized by:
   - a first electronic communication device;
   - a second electronic communication device which is in communication with said first device via the hose; and
   - at least one electronic safety barrier, which safety barrier interconnects one of said communication devices and the hose.

2. The system as claimed in claim 1, characterized in that a first safety barrier interconnects the first communication device and the hose, and a second safety barrier interconnects the second communication device and the hose.

3. The system as claimed in claim 1 or 2, characterized by a third electronic safety barrier interconnecting the first communication device and means for controlling transfer of fluid through the hose, said means being electronically controlled by the second communication device.

4. The system as claimed in claim 3, characterized in that the third safety barrier is further connected to an overfill detector provided at a first reservoir, said means being further electronically controlled by the overfill detector.

5. The system as claimed in claim 3 or 4, characterized in that said means for controlling transfer of fluid through the hose comprises an electronically controlled valve provided at an inlet of the first reservoir.

6. The system as claimed in any one of claims 3-5, characterized in that said means for controlling transfer of fluid through the hose comprises an electronically controlled pump provided at an outlet of a second reservoir.

7. The system as claimed in any one of claims 1-6, characterized in that said first communication device is an electronic interrogator, and said second communication device is an electronic label containing relevant information on the second fluid reservoir.

8. The system as claimed in any one of claims 1-7, characterized in that the first reservoir is a road tanker, and the second reservoir is a fuel depot tank.

9. The system as claimed in any one of claims 1-7, characterized in that the first reservoir is a road tanker, and the second reservoir is a fuel retail tank.

10. The system as claimed in any one of claims 1-9, characterized in that the safety barrier is a Zener barrier comprising Zener diodes.

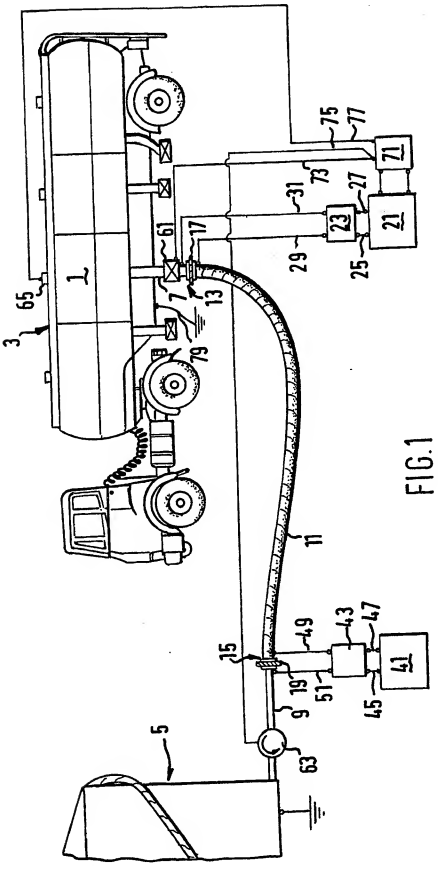
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FIG.1

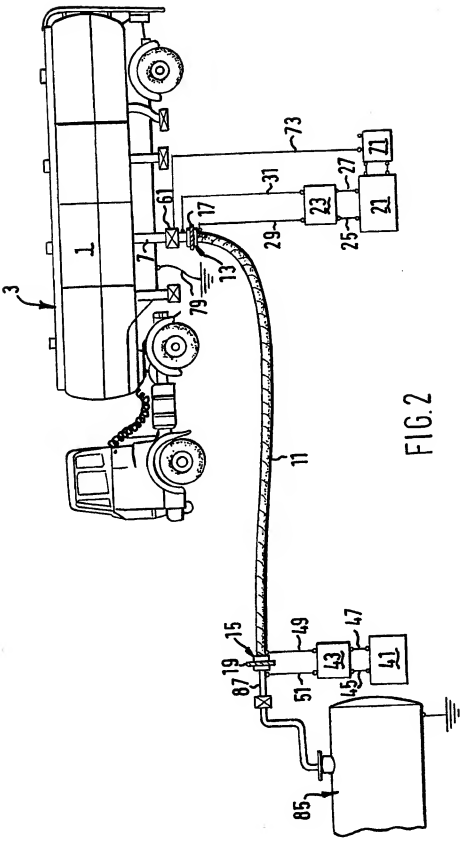

FIG.2

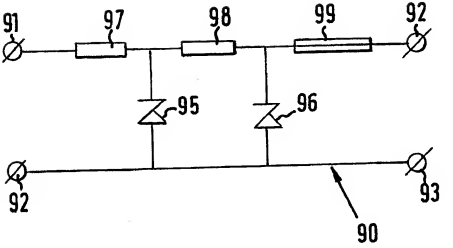

FIG.3

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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0168

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	FR-A-2 600 318 (SEVERIN) * Page 2, line 17 - page 3, line 4; page 4, line 21 - page 5, line 3; figures 1,6 *	1,7,10	B 67 D 5/32 B 65 D 5/33
D,Y	EP-A-0 258 935 (NEDAP) * Column 3, lines 13-22 *	1,7,10	
A	EP-A-0 330 860 (SCHERING AG) * Column 3, line 4 - column 4, line 21; figure *	2,5,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
B 67 D H 02 H

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	12 April 91	MARTINEZ NAVARRO A

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
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P: intermediate document
T: theory or principle underlying the invention

E: earlier patent document, but published on, or after the filing date
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